GOOD MAINTENANCE PRACTICES FOR CALIFORNIA HIGHWAYS

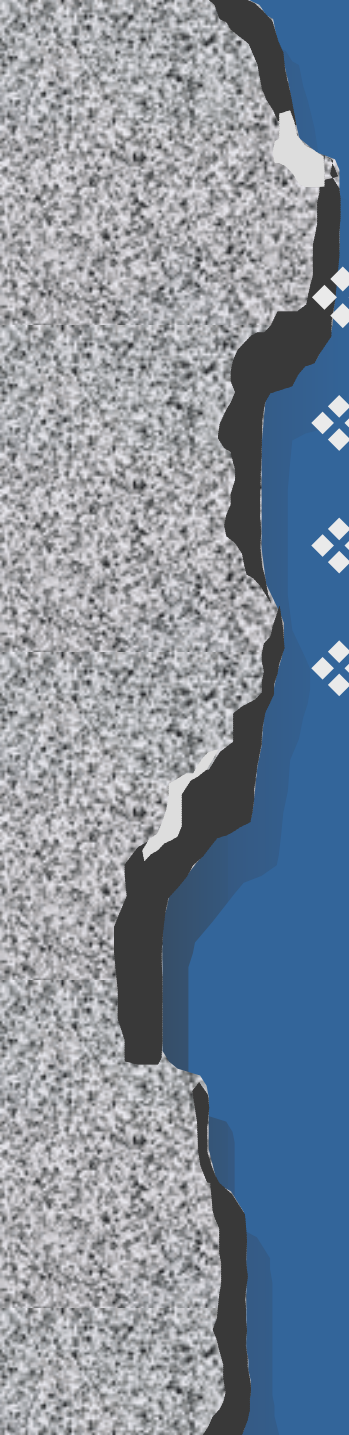
Six steps to recovery

AVAILABLE TECHNIQUES FOR GOOD MAINTENANCE

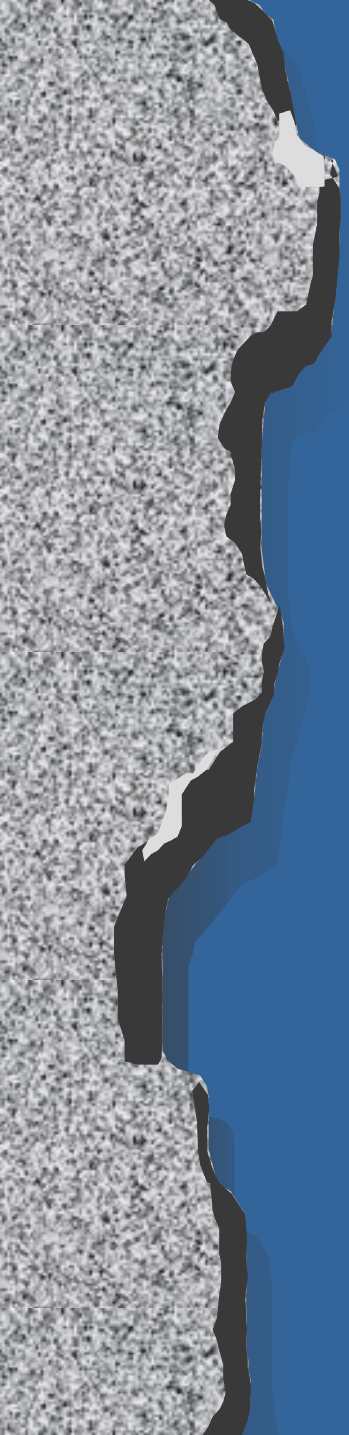
- Spall Repair
- Slab Replacement
- Diamond Grinding
- Slab Jacking
- Shoulder Repair
- Crack Seal

Spalls

Spall Repair



- Correct surface distress
- Extend the Life of PCC
- Restore ride quality
- Occurs in the upper half of the slab



Causes of spalling

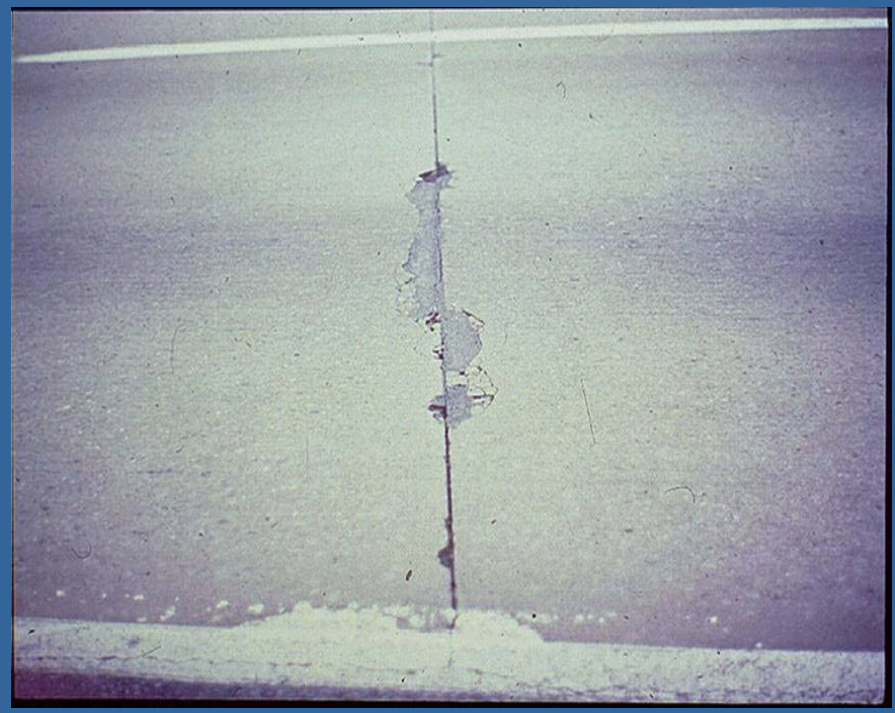
Use of metal joint inserts

Intrusion of incompressible material into joints

Scaling caused by over finishing, or weak concrete

Reactive aggregates

1. Select & mark repair area

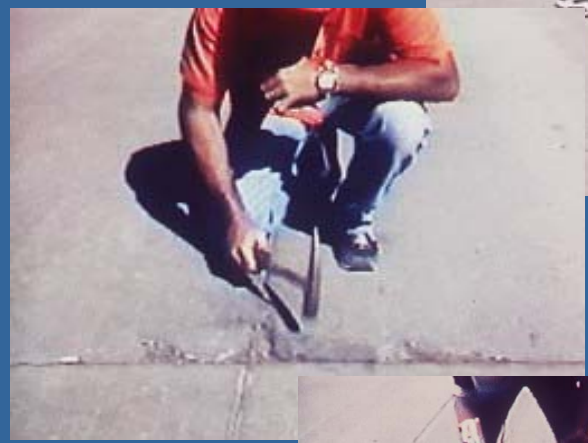


Best suited for…

- Joint spalling caused by intrusion of incompressible materials.
- Spalls associated with localized areas of weak concrete, scaling, clay balls or high steel
- Joint spalling associated with joint inserts

Sound with steel chain, ball peen hammer, or steel rod

- Drag chain over surface
- Tap hammer or rod on surface
- Listen for hollow sound
- Mark limits of delamination



Spall Repair (saw cutting)

Spall Repair (saw cutting)

Removal (using chipping hammer or 30 lb jack hammer)

Final Removal

Poor workmanship

Install bond breaker at joint

- Install a bond breaker in all patch joints. Avoid placing repair material directly against the adjacent slab.
- Use bond breakers with a scored top for easy reservoir creation/sealing.
- Extend the bond breaker 3 in beyond and 1 in below the repair boundaries.
- Use compressible bond breaker that is slightly wider than the joint.

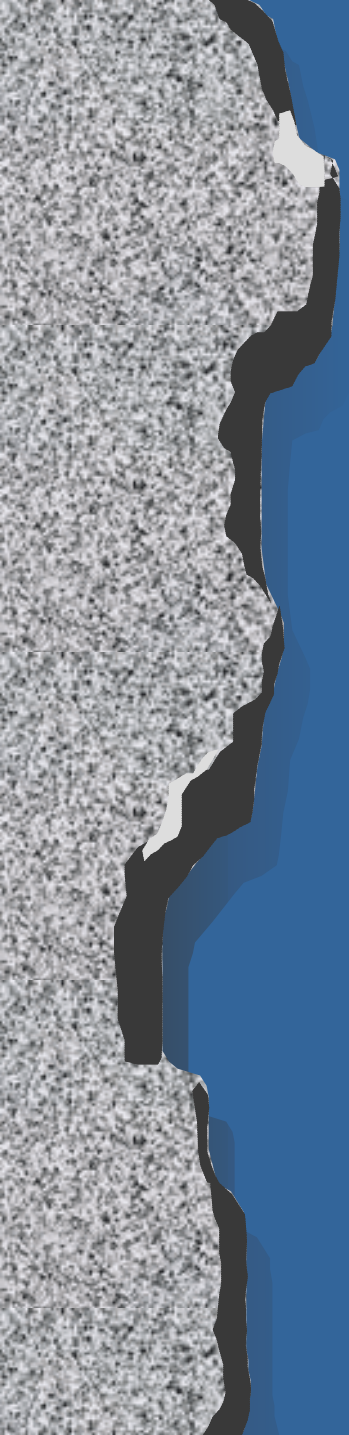
Back fill Material

Typical criteria for SLAB REPLACEMENT

- Third stage cracking
- Spalled and faulted cracks
- Excessive faulting or spalling at joints
- Severe drainage problems (pumping)
- Blowups

3rd Stage Cracking

3rd Stage & Corner Cracking



Slab Replacement

- Repair deteriorated slabs
- Improve pavement rideability
- Improve structural integrity
- Extend pavement service life
- Represents a large cost item

Slab Removal

1. Non destructive slab removal.
2. Saw cut slab night before.
3. Place bond breaker
4. Place dowels if necessary
5. Deliver mix to job site with hydration stopped, or a volumetric mixer.

Saw cut slab prior to removal

Slab Replacement lift out Method

CTB is usually in good condition

Bond Breaker, Foam Board, Isolation joint material

Placement of type III Material

Volumetric Mixer with Proprietary cement

Concrete Placement

Finishing

1. Finishing time is up to 30 minutes for portland mixes, less for proprietary cements.
2. The mix can slump out if on a slope.
3. Make sure to apply a good curing compound.
4. Cover entire slab with plastic to retain heat at night.
5. Tine or burlap finish after initial set.

Uncured concrete

Final Texturing

Curing Application

Finished Slab Replacement

THE ULTIMATE QUESTION!

- *How do I make limited budget dollars stretch and provide a highway system that offers a high level of service?*

Grinding

- Restore pavement ride quality
- Uniform profile by removing faulting
- Slab warping
- Patching unevenness
- Extends pavement service life
- Cost $25,000 to $30,000 a lane mile

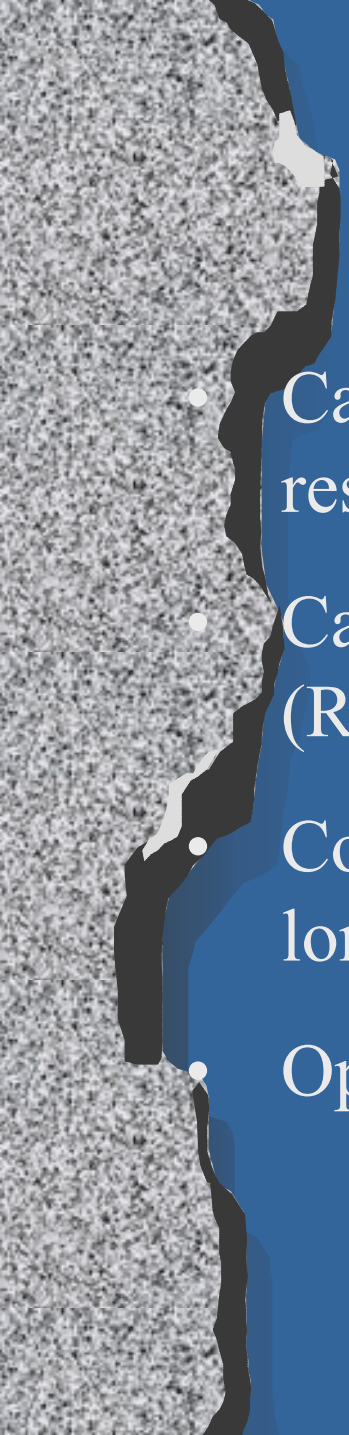
DIAMOND GRINDING

- Removal of thin surface layer of hardened PCC using closely spaced diamond saw blades mounted on the high speed rotating drum of a grinding machine.

Purposes of Diamond Grinding

- Remove roughness of PCC surface from:
  - Faulting
  - Wheelpath "rutting"
  - Curling
- Improve surface texture and friction characteristics caused by the polishing of aggregate and/or wearing away of the surface texture
- Adjustment of cross slope

1. Corrects irregularities due to faulting, cracking and curling.
2. A smooth surface-often as good as new pavement.
3. Less road noise.
4. Enhances surface texture and skid resistance.
5. Reduces accident rates by improving wet-weather friction.
6. Does not raise pavement surface elevation



- Can be applied only to the section in need of restoration.
- Can be carried out during off-peak traffic hours (Relatively fast process)
- Cost is less than overlay, and lasts twice as long.
- Operation does not affect concrete durability

We all need to start pulling together to help keep our environment cool & clean

Diamond-Grinding Machine


Not Recommended

Maintenance Issue's

Unacceptable Surface Grinds

Acceptable Surface Grinds

Diamond Grinding Conclusions

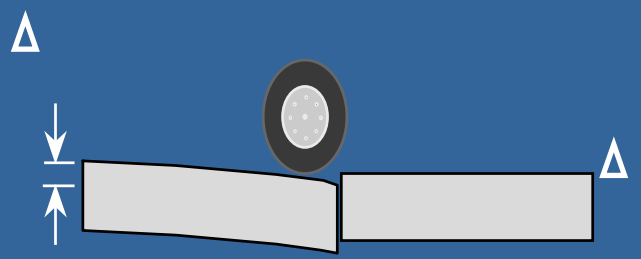
- Typical surface life of 10 to 16 years, depending on climate and traffic
- Concrete pavement can be ground up to 3 times without significantly compromising fatigue life
- Grinding reduces the redevelopment of faulting
- Diamond grinding can reduce roadside noise

Dowel Bar Retrofit

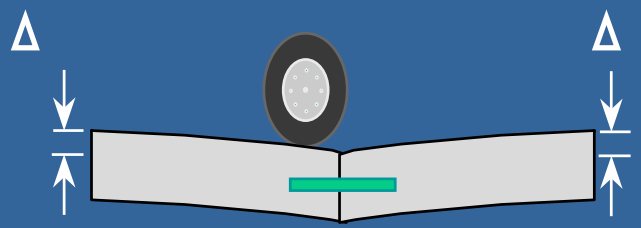
- Increases load transfer by linking the slabs together so the load is distributed evenly across the joint
- Increases the pavements structural capacity
- Reduces the potential of faulting
- Decreases the stresses and deflections

Purpose of Dowel bar Retrofit

- Reestablish load-transfer across joints or cracks
  - Load-transfer is a slab's ability to transfer part of its load to its neighboring slab
- Dowels in pavements limit future faulting



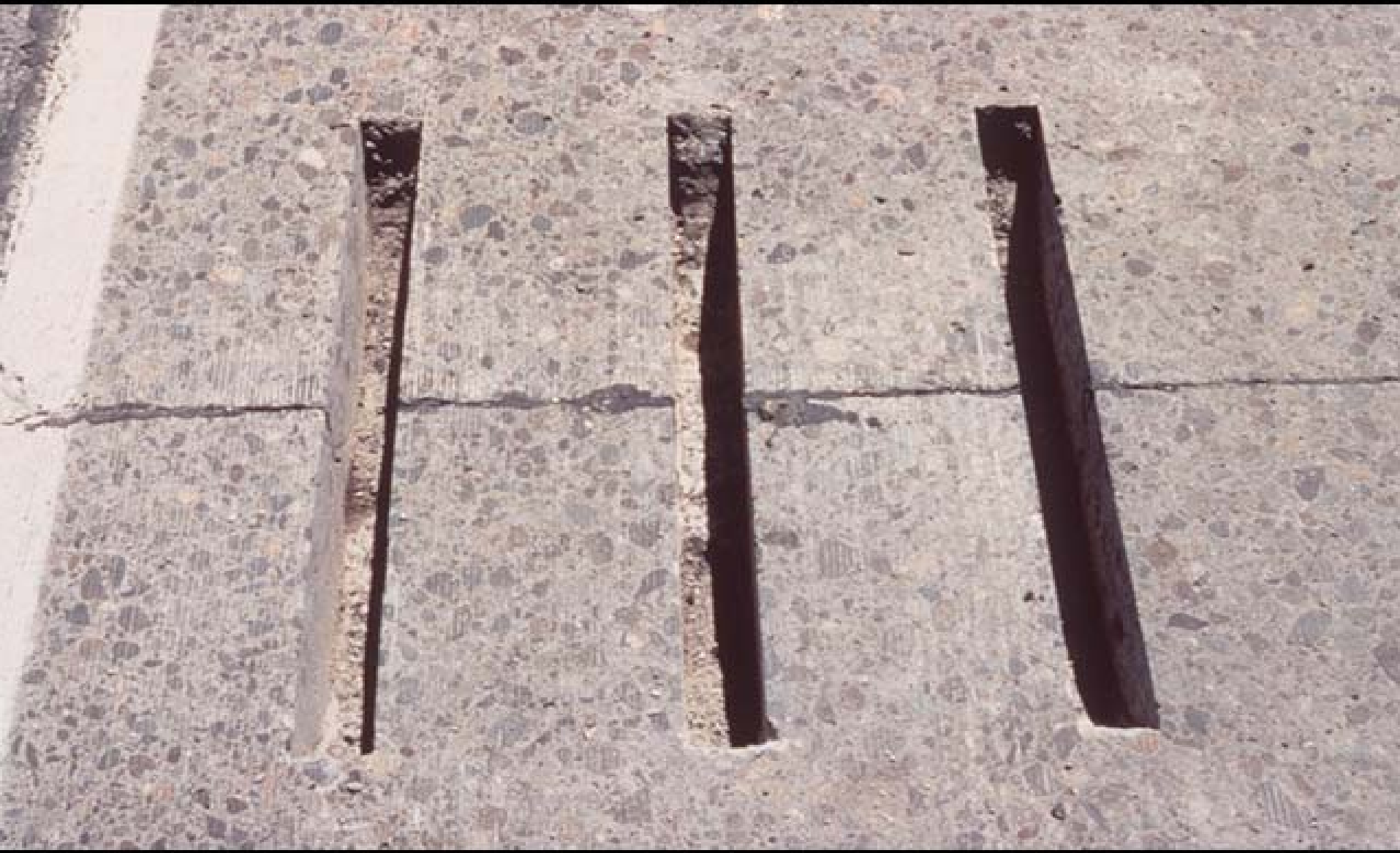
Load Transfer = 0% (Poor)



Load Transfer = 100% (Good)

Multiple Slots cut in one pass

Dowel Bar Retrofit Slots



Dowel Bar Retrofit

Dowel Bar Retrofit

Maintenance Issue's

At this time the Department is determining the strength required for proper DBR, then demonstration projects will be built. The revised spec should be ready in about 6-12 months.

Slab Jacking

Highway engineers must sometimes deal with rigid concrete pavement slabs that have settled over weak or severely eroded base and subgrade materials.

Slab Jacking with polyurethane

What is it?

Drill 16 mm (0.63-in) holes through the PCC, typically spaced (4 to 6 ft) in all directions.

Benefits of Polymer Injection vs. Standard Grout Injection (cont.)

- Six to ten times faster installation
- No need to overlift slab to account for grout shrinkage
- Quieter injection operations
- No respiratory testing and equipment required for operators

SWANSON SPEED SQUARE
TOP CUTS
HIP-VAL

RIP-VAL
TOP CUTS
COMMON
DEG.
PIVOT

Shoulder Repair

- Maintenance
  - Preserves the existing pavement; no structural improvement
    - Examples:
      - Crack Sealing
      - Minor Patching
      - Mill about (0.20 inches) and replace
      - Surface Treatments
    - Seal joint between the concrete and the AC shoulder reduces water in the edge drain by 70%

Shoulder repair during diamond grinding extends the life of the pavement and makes the highway appear to be new.

Why do we Clean & Crack Seal PCC?

Cost of Different Joint Sealant

Hot applied asphalt sealant

- .15 cents per foot
- will last 2 to 3 years

Silicone sealant with backer rod

- .40 to .50 cents per foot
- will last 6 to 10 years

6 cell preformed compressible seal

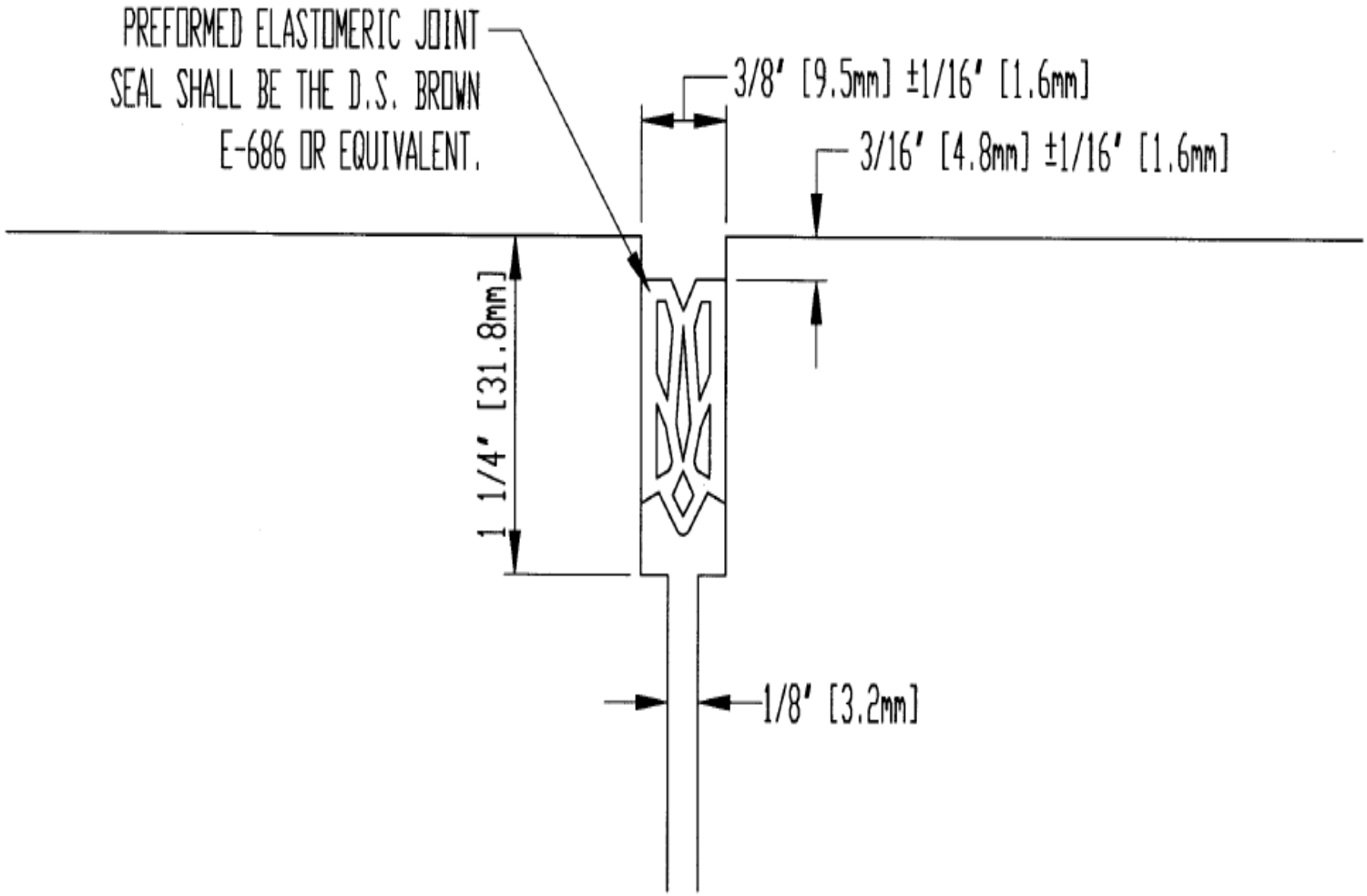
- .50 to .60 cents per foot
- will last 15 to 20 years

Intrusion of incompressible material into joints

Hot Applied Sealant

Silicone and Backer Rod

6 cell preformed seal



Installation of Backer Rod

Installation of Backer Rod

Backer Rod Installed

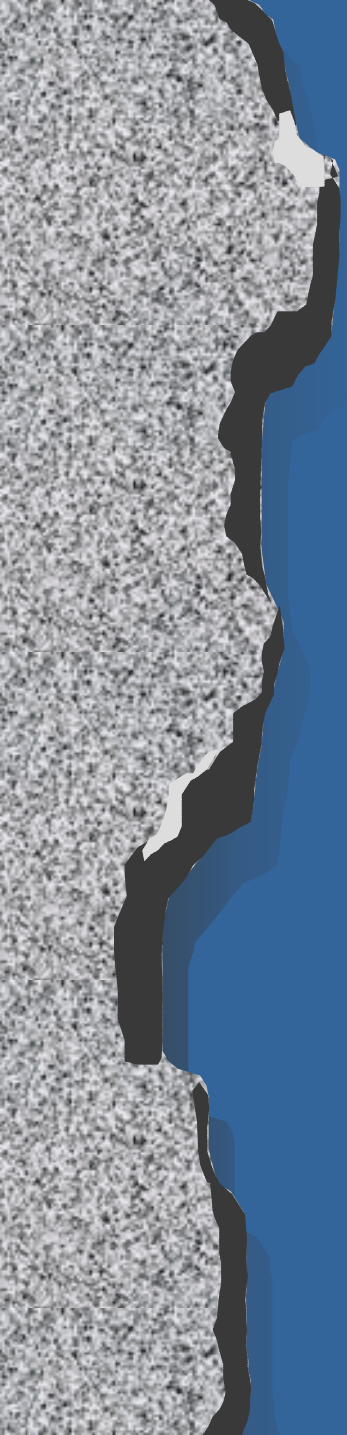
Installing Silicone

Tooling Silicone

Finished product

Rules of Thumb for Crack Sealing

- Rules of Thumb
- Crack Sealing
  - For all cracks (do not seal the longitudinal joints)
  - Clean cracks with forced air
  - Don't over-fill the crack with sealant; avoid surface smears
  - Clean up the area of excess sealant or sand if applicable



QUESTIONS?